





Overview

Introduction

As a boat crew member, towing will be one of the responsibilities you will execute for many types of maritime craft. This chapter covers forces in towing, towing equipment, safety and procedures. Boat crews need a firm grasp of towing principles to ensure that a "routine" evolution does not result in injury, death or further damage to property. No two towing evolutions are exactly the same. Variations in technique and procedure will occur. Apply your knowledge of principles and standard procedures to account for weather and sea conditions, vessel types, and crew experience. Ensure the tow is within your and your vessels capabilities.

The Coast Guard Addendum to the National Search and Rescue Manual states policy on vessel-assistance towing. Standard-Boat Operators Handbooks provide specific procedures for those types of boats. Individual manufacturers' boat owner's guides and product specification sheets provide equipment limitations and safety information. Boat Crew Qualification Guides address crew performance requirements. Chapter 1, *Boat Crew Duties and Responsibilities*, to this manual, outlines the towing watch responsibilities. Be familiar with and comply with the policies, direction and information in these sources.

In this chapter

These items are discussed in this chapter:

Section	Title	See Page
A	Towing Safety	17-3
В	Forces in Towing	17-7
С	Towing Equipment	17-17
D	Towing Procedures	17-37
Appendix A	Towing Precautions	17-77

Coast Guard Boat Crew Seamanship Manual





Section A. Towing Safety

Overview

Introduction

SAFETY is always the most important concern. Every towing activity is potentially dangerous. The safety of your crew and the crew of the towed vessel is more important than property, and your primary responsibility in any towing situation is to maintain safety measures. Towing is a complex evolution. A safe and successful outcome hinges on crew professionalism, ability, and **teamwork**.

Chapter 4 is dedicated to safety-related items, including risk management and team coordination. Towing-specific applications are covered here.

In this section

These items are discussed in this section:

Topic	See Page
Assessment and Awareness	17-4
Risk Management Planning	17-5



Assessment and Awareness

A.1. Risk assessment

Every boat crew member is responsible for identifying and managing risks. Prevent towing mishaps by honestly evaluating risks involved in every step of any towing evolution. Communicate with the towed vessel's crew who may have important information necessary to complete a successful mission.

WARNING *

Do not let a perceived need to engage in a towing mission override a complete, honest risk assessment process that emphasizes personnel safety.

A.2. Situational awareness

The dynamics of a towing situation continuously change from the time pre-towing preparations begin until mooring at the conclusion of the mission. All crew members must stay fully aware of the constantly changing situation at any given time during a towing evolution. Know what goes on around you and how things change. Reinforce crew awareness through communication: comment on what you think you see happening, and involve the towed vessel's crew. The "outside" view could provide information on things not visible from the towing vessel.

When clues indicate that situational awareness is being lost, a decision must be made whether or not to continue with the towing evolution. A decision takes the form of action/reaction and communication. Everyone in the crew has a responsibility in making decisions.



Risk Management Planning

A.3. Risk management

Realistic towing training based on standardized techniques, critical analysis, and mission debrief will contribute to risk management and the development of a towing risk management plan. All crew members must contribute to risk management planning.

Standard precautions at the end of this chapter (Appendix 17-A) make up the basis for a towing risk management plan, but keep in mind that each towing evolution is unique, and revise the plan for whatever the situation dictates. Refer to Chapter 4 for discussion of Risk Assessment and Management.





Section B. Forces In Towing

Overview

Introduction

Boat crews must understand the forces, or types of resistance, which act on the towed vessel and how to handle the resistance safely. They are the same forces that affect all vessels, but a distressed vessel is limited in how it can overcome them. The towing vessel must provide the means to move the towed vessel. The towline or tow rig transfers all forces from the towed vessel to the towing vessel. Learn to recognize the different forces and each of their effects individually to effectively balance and overcome them when they act together.

In this section

These items are discussed in this section:

Topic	See Page
Static Forces	17-8
Dynamic Forces	17-10
Combination of Forces and Shock-load	17-14



Static Forces

B.1. General

Static forces cause a towed vessel to resist motion. The **displacement** or mass of a towed vessel determines the amount of force working against the vessel. The assisting vessel must overcome these forces before the towed vessel moves. **Inertia** and the **Moment of Inertia** are two different properties of static forces which cause resistance in towing vessels.

B.2. Inertia

In this case, inertia is the tendency for a vessel at rest to stay at rest. The more mass a vessel has (the greater its displacement), the harder it is to get it moving.

B.3. Moment of inertia

The Moment of Inertia occurs when a towed vessel resists effort to turn about a vertical axis to change heading. The larger the vessel, the more resistance there will be in turning the vessel. Unless necessary in a case of immediate danger, **do not** attempt to tow a distressed vessel ahead **and** change its heading at the same time. (See figure 17-1.) Both inertia and the moment of inertia will be involved in the resistance of moving the distressed vessel, which can cause potentially dangerous situations and greater resistance for towing. Both vessels, their fittings, and the towing equipment take much less stress and strain when the two forces are conquered individually.

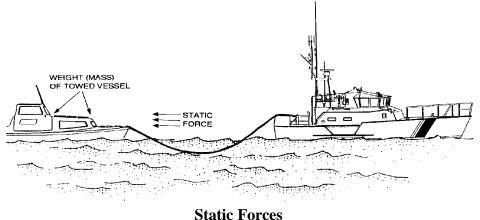


Figure 17-1



Overcome the effects of static forces by starting a tow **slowly**, both on the initial heading or when changing the towed vessel's heading. A large amount of strain is placed on both vessels, their fittings and the towing equipment when going from dead-in-the-water to moving in the desired direction and at the desired speed. Use extreme caution when towing a vessel of equal or greater mass than the assisting vessel. In such situations, the assisting vessel strains the capacity and capability of its equipment, requiring slow and gradual changes.

B.3.a. Starting the tow on the initial heading

Apply the towing force on the initial heading to gradually overcome the towed vessel's inertia. As the towed vessel gains momentum, slowly and gradually increase speed. To change the tow direction, make any change slowly and gradually after the towed vessel is moving.

B.3.b. Changing the towed vessel's heading

Apply the towing force perpendicular to the vessel's heading. Once the towed vessel starts to turn, resistance will develop. Apply turning force slowly and gradually. It is more difficult to change the initial heading of a heavy vessel (one with a high moment of inertia) than a light one. Now, begin to tow in the desired direction and gradually overcome inertia to get the towed vessel moving forward.

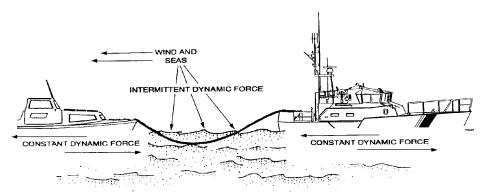
Once making way, the effects of static forces lessen. Until the tow achieves a steady speed and direction, apply effort to defeat any remaining inertia or to change the towed vessel's momentum gradually.



Dynamic Forces

B.4. General

Dynamic forces occur once the towed vessel is moving. They are based on the towed vessel's characteristics (shape, displacement, arrangement, rigging), the motion caused by the towing vessel, and the effects of waves and wind. (See figure 17-2)



Dynamic Forces Figure 17-2

B.5. Momentum

Once a vessel moves in a straight line, it wants to keep moving in a straight line. The greater its displacement or the faster it is moving, the harder it is to stop or change the vessel's direction.

B.6. Angular momentum

Once the vessel's heading begins to change, it wants to keep changing in that same direction. The faster the towed vessel's heading changes, the harder it is to get the tow moving in a straight line.

The towed vessel's momentum will gradually increase with towing speed. Momentum in a straight line will resist effort to change the towed vessel's direction and will tend to keep the towed vessel moving when tension in the towing rig is decreased. If necessary to first change the direction of the tow, the towed vessel will develop angular momentum while the vessel's heading is changing. You may need to apply towing force opposite the swing, before the towed vessel achieves the desired heading. The key to dealing with momentum is to anticipate how momentum will affect the towed vessel's motion and apply an offsetting force early and gradually.



B.7. Frictional resistance

As a vessel moves, the layer of water in immediate contact with the hull move. Due to friction between water molecules, the layers of water close to the hull try to drag along. The vessel appears to move "through" the water. This attempt to drag water alongside takes energy. As speed increases, this action becomes "turbulent." This turbulence takes additional energy, and more speed requires even more power.

NOTE &

Frictional resistance also varies with hull shape. Greater underwater (wetted) surface area causes greater frictional resistance. Hull appendages, such as propellers, shafts, skegs, keel, and rudders contribute to wetted surface area and frictional resistance.

CAUTION!

Frictional resistance will constantly affect the tow, *normally* keeping some steady tension in the towing rig. Since the shape and wetted surface area of the towed vessel will not change, frictional resistance is managed with towing speed. Higher towing speed causes higher frictional resistance and more strain on the towing rig.

B.8. Form drag

Form drag plays a large role in the ability to control changes in the towed vessel's movement. Different hull shapes react to motion through the water in different ways. The shape and size of the towed vessel's hull can either help or hinder effort to move in a straight line, when changing heading, and motion changes in response to waves due to buoyancy. The less water a hull shape has to *push* out of its way, the easier it will move through the water. A deep-draft, full-hulled vessel takes more effort to move than one with a fine, shallow hull. A large amount of lateral resistance, spread evenly over the length of the hull, will hinder effort to change a towed vessel's direction, but will help offset angular momentum in steadying up on a desired heading. A towed vessel may be able to help offset form drag by using its rudder.



B.9. Wave making resistance

A surface wave forms at the bow while the hull moves through the water. The size of the bow wave increases as speed increases, causing the wave to create resistance for the bow to be pulled or propelled through the water.

Keep in mind the different hull types of maritime craft, including the towing vessel. In any towing evolution, the boat crew must be able to recognize a vessel's hull type, as well as its critical capabilities and limitations. Dependent on the type of hull, towing vessels must be careful not to tow a vessel faster than the design speed of its hull. Refer to Chapter 8, *Boat Characteristics*, for discussion of different hull types.

CAUTION!

It is not always safe to tow a planing hull type of vessel above planing speed. Going from displacement speed to planing speed, or back, can decrease the towed vessel's stability and cause it to capsize. Also, wave drag (even one large wake) could slow the hull down to displacement speed and cause a severe "shock-load" as the towed vessel tries to get back on plane.

NOTE &

"Shock-load" or "shock-loading" is the rapid, extreme increase in tension on the towline, which transfers through the tow rig and fittings to both vessels.

B.10. Wave drag, spray drag, and wind drag

These frictional forces act on the hull, topsides, superstructure, and rigging. They all have a major effect on the motion of the towed vessel, and the transfer of forces to and through the towing rig. These constantly changing forces all vary with the towed vessel's motion relative to the environmental elements and are directly related to the towed vessel's amount of exposure to them. These forces can add up and **cause shock loading**. Wind and wave drag also cause a distressed drifting vessel to make leeway, that is motion in a downwind direction.

B.10.a. Wave drag

Wave drag depends on the "normal" wetted surface area of the hull and the amount of freeboard exposed to wave action. Wave drag has a large effect on the strain of the tow rig.

- In large seas, be aware of:
 - Combination of wave drag and form drag could overcome the towed vessel's forward momentum and cause the towed vessel to stop and transfer a large amount of strain to the tow rig.



- Shock-load could damage vessel fittings, part the towline, and endanger both vessel crews.
- In head seas, be aware of:
 - Towing vessel can only control the effect of wave drag by the speed and angle that the towed vessel encounters the waves.
 - Limiting speed and towing at an angle to the seas to prevent them from breaking over the bow of the towed vessel.
- In following seas, be aware of:
 - Wave drag causing the towed vessel to speed up as the crest approaches, increasing speed to keep tension in the towing rig, and reducing speed as the crest passes.

B.10.b. Spray drag

Spray drag also provides resistance to the tow. The spray from a wave could slow the towed vessel and increase the amount of shock loading. Spray drag could also adversely affect the towed vessel's motion by imparting a momentary heel, pooling on deck or in the vessel cockpit, and in cold weather form ice, and thus decrease stability.

B.10.c. Wind drag

Wind drag can cause shock loading and have a bad effect on the towed vessel's motions and stability. A steady beam wind can cause list and leeway, while a severe gust can cause a threatening heel. List, heel, and leeway may cause the towed vessel to yaw. A headwind increases tow rig loading in a direct line with the towed vessel while the towed vessel crests a wave, causing shock-loading.

B.11. Buoyancy response and gravity effects

WARNING 🖖

Once making way, a vessel's buoyancy response or the effect of gravity in a seaway may cause severe shockloading.

Develop a feel for the towed vessel's initial and reserve buoyancy characteristics, overall stability, sea keeping, response to the prevailing environmental conditions, and the response to being towed. Though a distressed vessel may *seem* stable and sound at rest, its response in tow could be a capsize. A towed vessel's bow may react to an oncoming wave by pitching skyward, or by "submarining." Buoyancy response to following seas could cause the towed vessel to yaw excessively or gravity may cause it to gain speed and "surf" down the face of a wave.



Combination of Forces and Shock-load

B.12. General

A boat crew rarely deals with only one force acting on the tow. The crew usually faces a combination of all the forces, each making the situation more complex. Some individual forces are very large and relatively constant. Crews can usually deal with these safely, provided all towing force changes are made slowly and gradually. When forces are changed in an irregular manner, tension on the tow rig starts to vary instead of remaining steady.

Example:

CAUTION!

Shock-loading may cause severe damage to both towing and towed vessels and overload a tow rig to the point of towline or bridle failure.

Shock-loading could also cause momentary loss of directional control by either vessel and could capsize small vessels.

In calm winds and seas, a towing vessel encounters a steady, large amount of frictional resistance, form drag and wave making resistance when towing a large fishing vessel with trawl lines fouling its propeller and net still down. The tow rig and vessel fittings will be under heavy strain, and the tow vessel engine loads will be rather high, but the tow proceeds relatively safely. If suddenly the net tangled and caught on an unseen obstacle, this new "force" acting through the tow rig could immediately increase stress to a dangerous level. This shock-load could part the towline or destroy fittings.

(In the example above, the prudent solution would be to make a "safe" tow by recovering the net or marking it and letting it loose before starting the tow.)

Though this example began as a safe and steady tow, a single unexpected incident could have caused a very dangerous situation. Always keep in mind that some degree of shock-loading can occur during any tow evolution.

B.13. Shock-loading prevention or counteraction

Because of the potential dangers, the tow vessel must use various techniques to prevent or counteract shock-loading, or reduce its effect.



Action	Effect
Reduce Towing Speed	Slowing down lowers frictional resistance, form drag, and wave-making resistance. Reducing these forces will lower the total tow rig tension. In head seas, reducing speed also reduces wave drag, spray drag, and wind drag, lowering the irregular tow rig loads. The total reduction in forces on the tow could be rather substantial. When encountering vessel wake in relatively calm conditions, decrease speed early enough so the towed vessel loses momentum before hitting the wake. A small towed vessel slamming into a large wake will shock-load the tow rig, and may even swamp.
Get the Vessels "In Step"	Extreme stress is put on the tow rig in heavy weather when the tow vessel and the towing vessel do not climb, crest or descend waves together. Vessels in step will gain and lose momentum at the same time, allowing the towing force to gradually overcome the towed vessel's loss of momentum, minimizing shockloading. To get the vessels in step, <i>lengthen</i> rather than shorten the towline if possible.
NOTE &	When operating near bars and inlets, getting the vessels in step may be impractical due to rapidly changing water depth and bottom contours.
Lengthen the towline	A longer towline reduces the effect of shock-loading in two ways. The weight of the line causes a dip in the line called a catenary . The more line out, the greater the catenary. When tension increases, energy from shock loading is spent on "flattening out" the catenary before it is transferred through the rest of the rig and fittings. The second benefit of a longer towline is more stretch length. Depending on the type of towline, another 50' of towline length will give 5'-20' more stretch to act as a shock-load absorber. Remember to lengthen the towline enough to keep the vessels in step and minimize the shock-load source.



Action	Effect	
Set a Course to	Do not try to tow a vessel either directly into or	
Lessen the Effect	directly down large seas. Tow on a course to keep	
of the Seas	the seas 30-45 degrees either side of dead ahead or	
	dead astern. This may require "tacking" to either side	
	of the actual desired course.	
Deploy a Drogue	This device (covered under Equipment) may help to	
from the Towed	prevent the towed vessel from rapidly accelerating	
Vessel	down the face of a wave. The drogue does add form	
	drag to the tow, but could prevent shock-load.	
Constantly	In large seas, constant "finesse" techniques may	
Adjust Towing	reduce shock-loading. This requires the coxswain to	
Vessel Speed to	constantly observe the towed vessel, and increasing	
Match that of the	or decreasing towing vessel speed to compensate for	
Towed Vessel	the effects of approaching or receding seas on the	
	towed vessel. This takes much practice and	
	experience.	
NOTE &	Safety demands emphasis on preventing shock-load and reducing its effects. Shock-loading presents a definite possibility of vessel fitting or tow rig failure. One of the	
	more feared possibilities is towline snap-back. Think of this as a greatly magnified version of stretching a rubber-band until it breaks. Remember, some nylon cordage can stretch up to an additional 40% of its length before parting.	
CAUTION!		
	Shock-load can also capsize or swamp the towed vessel. The additional towing force from a shock-loaded towline could cause a smaller vessel to climb its bow wave and become unstable or it could pull the bow through a cresting wave.	



Section C. Towing Equipment

Overview

Introduction

When towing a boat or other maritime craft, always use the proper equipment for the task. Using the proper equipment minimizes accidents and possible injuries. Towing equipment includes towlines, pendants and bridles, deck fittings, hardware for attaching the towline (skiff hooks, shackles, etc.), fenders, drogues, and alongside lines. This section discusses the design, use, and limits of towing equipment.

In this section

These items are discussed in this section:

Topic	See Page
Towlines and Accessories	17-18
Messengers	17-25
Chafing Gear	17-27
Deck Fittings and Other Fittings	17-28
Drogues	17-30
Other Equipment	17-35



Towlines and Accessories

C.1. Towlines

Towlines are usually 2-in-1 (double-braided) nylon, two to four inches in circumference. Length can be up to 900 feet. Use nylon instead of other synthetic fiber cordage for a good combination of strength and stretch (elongation and elasticity). The Auxiliary will have and use a variety of types and sizes of tow lines.

NOTE &

Refer to the chapter on Marlinespike Seamanship for a complete table of breaking strength for various circumferences of rope.

The towing vessel's construction, power, size, and fittings determine towline size (circumference). The proper towline will allow a vessel to tow up to its design limits. The towline will part before damage occurs to a vessel's fittings, structure or hull.

CAUTION!

Do not tow beyond the vessel's design limits by simply increasing towline size. If the towline's breaking strength exceeds the limits designed into the vessel's fittings and structure, damage and structural failure may result.

Each Coast Guard boat type has an equipment list that specifies towline length and size. Towlines will usually have an eye spliced into the tow end. Towline length and size will vary on other vessels due to design limits and available space. Offshore or in heavy weather, a towing vessel may need 500 feet or more of towline to keep a towed vessel in step and to minimize the effect of shock-loading.

C.1.a. Towline storage

NOTE &

Unless slipping the towline in an emergency, keep at least 4 turns of towline on the reel. Paying out the entire length can result in loss of both tow and towline. Store towline on a **tow reel** with the bitter end secured to the reel with small stuff. The line will lie evenly on the reel. More importantly, to quickly slip (release) the towline in an emergency, just cut the small stuff with a knife, and the bitter end runs free. When putting new cordage in service as a towline, splice an eye at both ends. This will allow an "end-for-end" switch before part of the towline is beyond useful service.

Many tow reels have mechanical advantage (hand crank, gear train) or electric motors to ease towline retrieval. These devices are only to retrieve a slack towline. Do not try to take any tension with these devices. Inspect the tow reel frequently for easy rotation and adequate lubrication.



C.1.b. Towline condition and inspection

Safe and efficient towing requires an undamaged, serviceable towline. Whenever any towline damage is found or suspected, remove or repair the damage. If removing damage shortens the towline to less than serviceable length then replace the towline. Usable sections can be used for bridles, alongside lines, mooring lines, etc.

Inspect towlines on a regular basis to detect damage from:

- Cuts
- Chafing
- Flattening
- Fusing (caused by overheating or over-stretching)
- Snags
- Hardening (heavy use will compact and harden a towline and reduce its breaking strength)

If a towline shows any of these characteristics, do not use it as a towline.

C.2. Towing pendants and bridles

It is not always possible, appropriate, or safe to attach a towline from the stern of a towing vessel to a single point on the bow of a distressed vessel. The distressed vessel's deck layout may not have a single direct run through a bull nose; there might not be a Samson post or centered bitt; the towline might be too large for deck fittings; or deck fittings may be improperly mounted, rotted or corroded where they attach to the deck. In these cases, rig a **pendant** or **bridle**. The pendant or bridle forms part of the tow rig, leading from the eye or thimble of a towline to the appropriate location(s) or deck fitting(s) on the towed vessel. Towing pendants and bridles are made of double-braided nylon or wire rope. (Use wire rope for large vessels or steel hulls.) The two most common rigs are a pendant and a bridle. Auxiliary facilities will have a variety of pendants and bridles, not necessarily constructed of double braided nylon or wire rope.

When possible, use pendants and bridles with breaking strength equal to or greater than the towline. If the towed vessel's fittings (chocks or cleats limit bridle or pendant size, consider "doubling-up" (two bridles or pendants). When expected towing force threatens safe working load of the individual bridle legs, if doubling-up, all lengths must be exactly the same so each part shares an equal load.



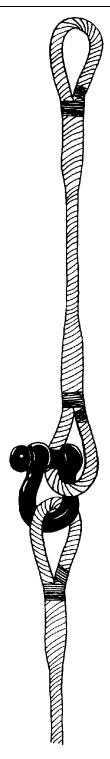
C.2.a. Pendants

Use a pendant to reduce wear and chafing at the towline end (particularly the eye and its splice). A pendant must be long enough so the towline connection is clear of obstructions on the towed vessel (See figure 17-3).

When attaching a bridle, use the following steps:

- Center the bridle with at least one round turn on the attachment point.
- Attach the bridle ends to the towline eye with a shackle.





Pendant Figure 17-3

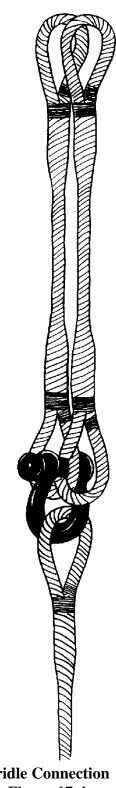


C.2.b. Bridle

Use a bridle (a "Y" bridle) when both legs can be rigged to exert an equal pull on the hull of a distressed vessel (See figure 17-4). A bridle provides the best results where towed vessel deck fittings (chocks and cleats or bitts) are not right at the towed vessel's bow (as a bullnose), or where obstructions (bulwark or rigging) on the bow prevent a pendant or towline from making a direct lead back to the towing vessel. Use the following list as a guideline for attaching a bridle for towing:

- Use a long bridle when the best attachment points for the towed vessel are well aft to either side of the deck, but maintain a fair lead forward to reduce chafe.
- Remember that the amount of tension on each bridle leg increases with the size of the angle between the bridle legs.
- Keep the legs of the bridle long enough so the angle of the legs stays less than 30 degrees.
- The legs must be long enough to reduce towed vessel yaw.
- Protect bridles with chafing gear when necessary.
- Use thimbles in the bridle leg eyes where they meet.
- When shackled to the towline, remember to mouse the shackle pin.





Bridle Connection Figure 17-4



A bridle is also used by towing vessels without centerline towing capability or with transom obstructions (outboard motors or rigging). Attach the bridle to fittings in a manner to clear the obstructions. Again, bridle leg lengths must be equal to share the strain of the tow.

C.2.c. Pendant and bridle condition and inspection

NOTE &

Inspect towlines, pendants, and bridles after each tow and whenever shock-loading has occurred. Safe and efficient towing requires undamaged, serviceable pendants and bridles. Inspect pendants and bridles on a regular basis to detect damage. **Ensure bridle leg lengths are equal**. For nylon pendants and bridles, use the towline condition and inspection list provided earlier in this section.

Wire rope bridles must be inspected for:

- Broken wires
- Fish Hooks (broken ends of wire protruding from the lay)
- Kinks
- Worn or corroded portions (worn portions of wire rope appear as shiny, flattened surfaces)



Messengers

C.3. General

A towline is too heavy to cast more than a few feet. In rough weather or when impossible to get close enough to throw a towline to a distressed vessel, use a **messenger** to reach the other vessel. A messenger is a length of light line used to carry a larger line or hawser between vessels.

C.4. Passing a towline

To pass a towline with a messenger, attach one end of a small line to the end of the towline and cast the other end to the other vessel's crew.

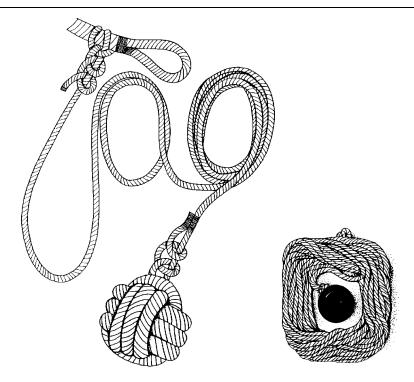
They use the lighter line to pull the towline across the distance between the vessels. Sometimes, multiple lines are used as messengers. An intermediate-sized line might be added between a heaving line and towline. The following may serve as a messenger for small vessel towing evolutions:

- Heaving Line and Heaving Ball
- Float Line
- Shot Line
- BOLO
- Shoulder Line Throwing Gear

C.4.a. Heaving line and heaving ball

A heaving line is made of light, flexible line with a monkey's fist at the thrown end. Sometimes, the monkey's fist is weighted. A variation of this is a heaving ball or heaving bag. Instead of a monkey's fist, there is a plastic or rubber ball permanently affixed to the end of a synthetic line. A heaving line must be in good condition, at least 75 feet long, and free of rot or weathering (see figure 17-5).





Heaving Line and Ball Figure 17-5

The bitter end of a heaving line is attached to the towline with a clove hitch, bowline, small carbiners, or snap hook. Slip clove hitches may work best in very cold weather. The longest heaves are cast downwind, but this may not always be possible. Target the throw above the center of the vessel so the thrown line crosses over the deck and avoids breaking glass or injuring people.

C.4.b. Float line

To reach a vessel beyond the range of a heaving line or in an inaccessible position, a buoyant synthetic line may be floated from upstream or upwind. Tie one end to a ring buoy or float, the other end to the towline, and throw the float line downstream in the direction of the distressed vessel. Let the current or wind carry the float line toward the other vessel. This method is only effective if the wind or current can get the float within range of the other vessel.



Chafing Gear

C.5. General

Chafing gear protects towlines, bridles and pendants from wear caused by rubbing against deck edges, gunwales, bulwarks, chocks, taffrail or tow bars.

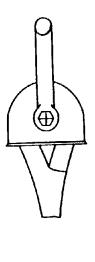
C.6. Preventing chafing damage

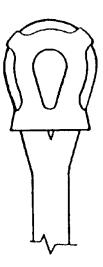
Tie layers of heavy canvas or leather with small stuff to the towline, bridle, or wire rope at contact points to prevent chafing damage. Sections of old fire hose also work well as chafing gear. Make sure the chafing gear stays in place for the duration of the tow.

C.7. Thimbles

Thimbles are designed to equalize the load on an eye of a line and provide maximum chafing protection to the inner surface of the eye. On double braided nylon, use thimbles made specifically for synthetic lines (See figure 17-6). Use galvanized "teardrop" shaped thimbles on wire rope.







Thimble Figure 17-6



Deck Fittings and Other Fittings

C.8. General

Fittings are attachment or fair lead points on vessels for towlines, anchor lines, and mooring lines. Many fishing and sailing vessels have other attachment points for standing and running rigging that could also provide tow rig attachment points or fair leads. For towing, only use attachment points and fair leads designed for horizontal loads.

Common fittings include bitts (mooring and towing), cleats, chocks, and Samson posts. A tow bar or taffrail acts as a fair lead. Do not overlook pad eyes, turning and snatch blocks, winch drums, capstans, and windlasses when considering attachment points or fair leads on a towed vessel. Trailer-able boats usually have an eye bolt or eye fitting at the bow for an attachment point.

C.9. Condition and inspection

Make regular inspections of towing vessel fittings. Check for cracks, fractures, rust, corrosion, wood rot, fiberglass core softening, or delamination. Inspect surfaces that are normally hidden from view, particularly backing plates and under-deck fasteners. Tow bars are subject to high vibration and may loosen or cause stress fractures around their foundations. Keep working surfaces free from paint and relieve any surface roughness. A smooth working surface reduces wear, friction and chafing on lines.

C.10. Skiff hook

The typical **skiff hook** has a quick release safety buckle and snap hook clip that can be attached directly to the boathook handle (See figure 17-7). Skiff hook assemblies are commercially available.

C.10.a. Using a skiff hook

Attach the skiff hook line to a towline with a shackle or double becket bend. Use the skiff hook assembly to reach down and place the hook into a small distressed vessel's trailer eye. The hook is snapped into the eye and the handle is slipped off the round stock and pulled back.

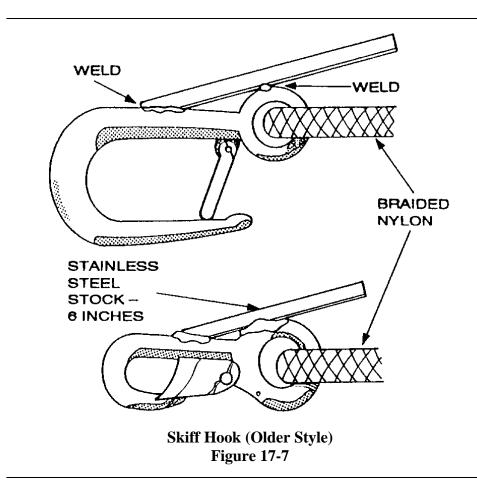
WARNING 💖

Do not over stress a skiff hook. Never use one for any operation that might be more of a load than towing small, trailer-able boats.

CAUTION!

Use extreme care when removing a skiff hook from a trailer eye fitting. Even at a dock, crew members risk injury from vessel movements.







Drogues

C.11. General

A **drogue** is a device that acts in the water somewhat the way a parachute works in the air. The drogue is deployed from the stern of the towed vessel to help control the towed vessel's motions. Coxswains and boat crews must familiarize themselves with the operating characteristics and effectiveness of available drogues. Train with and test drogues under various conditions to learn drogue capabilities. The time to learn about a drogue is before you need to deploy one.

While trailing a drogue from the towed vessel is not an unacceptable practice, and may be useful when a distressed vessel has lost rudder control, normally it is not deployed when well offshore. If necessary to tow a vessel with large swells directly on the stern, it may be more prudent to alter course or lengthen the towline rather than to deploy a drogue. Drogues are typically used when the tow is shortened as in preparing to tow into a bar or inlet. With a short hawser and large swells on the stern, the drogue is deployed to prevent the towed vessel from running up the stern of the towing vessel and keep tension on the towline to help prevent the towed vessel from "surfing" down the face of a wave.

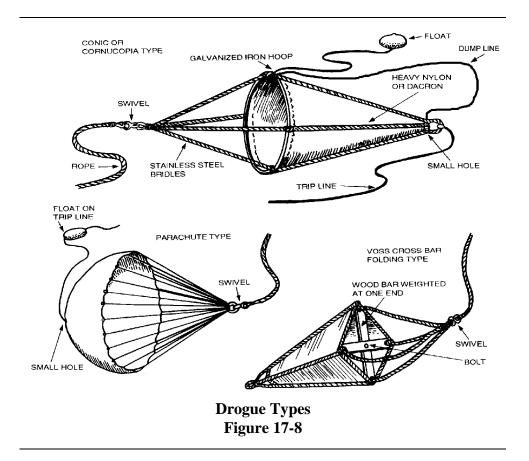
The idea of the drogue is to provide backward pull on the stern of the towed vessel so that the wave will pass under the boat. It is important to match the size of the drogue to the towed boat, its deck fittings, and its overall condition. The larger, well constructed cone drogues can exert a very large force on a boat's transom so the towed vessel's stern must be carefully examined.

There are numerous types, sizes and styles of drogues, all commercially available (Figure 17-8). Different-sized drogues are used for different conditions and different vessel sizes. A traditional drogue is a canvas or synthetic cloth cone, with the pointed end open. Drogues of this type have a ring in the base of the cone (the leading edge) to which attaches a fourpart bridle. The other ends of the bridle connect to a swivel, which in turn, connects to a line made fast to the stern of the towed vessel. The towed vessel "tows" the drogue. Drogues sometimes have another line attached to the tail end for retrieval.

NOTE &

A large drogue can cause stress that will damage a small boat. For a small boat, the larger the drogue used, the slower the towing speed must be. A slight increase in speed causes a tremendous increase in drogue tension.





C.12. Prepare the drogue gear

For the drogue towline, use 200 feet of 2-inch double braided nylon. Mark the drogue line every fifty feet.

NOTE &

Transfer the drogue rig to a distressed boat before taking it in tow. The following checklist will help ensure that the drogue rig and related equipment are ready for transfer.

Auxiliary facilities are not required to carry drogues.

- Visually inspect the drogue rig for worn rusted, or corroded fittings and swivels, correct size shackles, and untangled bridles.
- Ensure that the drogue rig has 200 feet of two-inch, double-braided nylon line properly attached to the bridle swivel using a correctly sized shackle. Make sure it has no sharp fittings or exposed wires, and is stowed in a manner that will keep it intact until it is deployed.
- Provide all necessary equipment with a drogue rig such as extra shackles, bridles, straps, and chafing gear to achieve the best possible connection on the stern of a tow.



- Place all equipment in a gear bag with laminated written instructions and illustrations on how to rig a drogue, both with and without a bridle. At night attach a chemical light to the bag and include a flashlight inside.
- Attach flotation to the bag, usually a fender (discussion in Section C.9.), and two lines, each 40 feet in length, to the handles of the gear bag. Bend a heaving line or buoyant rescue line onto one of the lines.

NOTE &

Determine what fittings the drogue will connect to, how to make the connection, and how much line to deploy BEFORE sending it to the tow. Always ask about backing plates, fitting sizes, and strength of materials involved. Be cautious if you cannot see an attachment point. Rely on your experience and judgment.

C.13. Pass the drogue

NOTE &

Unless a crew member from the towing vessel goes aboard the towed vessel, the towed vessel crew must carry out the following procedures. Provide them guidance and direction as needed. Pass the drogue directly from the towing vessel to the towed vessel when in the best position. The drogue and line can be heavy and awkward for the crew of the distressed vessel. If possible, maneuver the rescue vessel to pass the drogue to an area on the distressed vessel where the crew will not have to lift the apparatus a long distance.

Instead of immediately taking a boat in tow, stand by and watch the distressed vessel crew ready the drogue rig for deployment. Provide visual inspection, verbal direction, and clarification if necessary.

C.14. Rig drogue for deployment

Use attachment fittings as near the centerline as possible. On many vessels, a bridle will be needed to spread the load between two separate fittings to center the drogue towline. Winches, motor mounts, masts, and davit bases are other possible locations for good strong connections. When trying to compensate for a jammed rudder, attach the drogue well off the centerline, close to the quarter, opposite the side where the rudder is jammed.

• Connect the bridle legs or the drogue lines to the appropriate fittings.



C.15. Deploy the drogue

Start the tow moving, then direct the towed vessel crew to deploy the drogue.

- Move the tow forward slowly, just enough to control the tow.
- Direct the towed vessel's crew to recheck connections, put the drogue in the water and pay out the line slowly from a safe position. Unless circumstances direct otherwise, pay out all 200 feet of drogue line.

C.15.a. Begin or resume towing

WARNING 💖

Drogue use does not justify towing through breakers. When in doubt, stay

Once the drogue sets and starts to pull, slowly increase speed while the distressed vessel's crew observes the rig. Check attachment points and the effectiveness of a drogue. If adjustments must be made, slow down and make them.

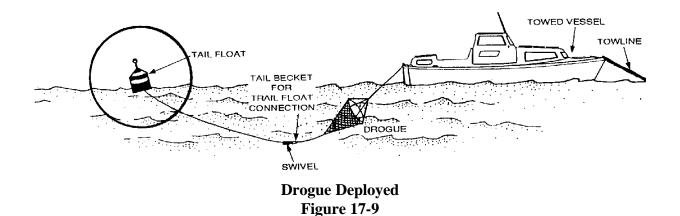
Once you deploy a drogue, pick the most comfortable course and speed. Control of the tow is more important than speed. Towing a drogue at too great a speed may damage the towed vessel or may cause the drogue rig to fail. One of the crew on the towed vessel should monitor the drogue.

C.16. Shorten-up and recover drogue

Because a tripping line is not recommended, several alternate recovery methods are available. If recovery is not properly set up and controlled, a drogue may become fouled on the tow, a buoy, or other object.

- Slow or stop the tow, then haul it in. The primary method for shortening up or recovering a drogue is accomplished by slowing the tow or stopping completely. Have people on board the tow slowly pull in the drogue. Provide enough maneuvering room to bring the tow around on a course causing little or no tension on the drogue line during recovery.
- Have another vessel come alongside and transfer the drogue line to it. The second vessel can recover the drogue rig.
- Attach a color coded **dumping line**, a short piece of line run from the bridle shackle to the tail of the drogue, outside the cone. Haul the drogue to the stern, recover the dumping line, and when pulled, it inverts the drogue making it easy to recover. A dumping line is only suitable for large drogues that drain slowly.





C.17. Drogue storage

A synthetic gear bag will hold the drogue for storage and deployment. The bitter end of the line feeds out through a grommet in the bottom and the remainder of the line is stuffed inside the bag. A drawstring at the top holds the bag closed. Ensure the line bag can hold 200 feet of 2-inch line.

C.18. Drogue condition and inspection

Inspect the drogue for tears, cuts and holes. Inspect the drogue towline and bridle using the same guidelines for towlines and bridles as listed in sections 17.C.1.b. Also check for worn, rusted or corroded fittings, swivels and shackles. Ensure there are no sharp edges or points of hardware.



Other Equipment

C.19. Alongside lines

At some point during a tow, the towing vessel most likely will need to tow the distressed vessel alongside in restricted waters or moor to the towed vessel. The tow vessel will usually need a combination of lines to allow for vessels of different size.

C.19.a. Alongside line storage

Each Coast Guard standard boat equipment list specifies number, length and size of **alongside lines** for vessel type. Stowage and weight considerations will guide other vessel types.

C.19.b. Alongside line condition and inspection

Alongside lines must be kept in the same condition as towlines and bridles (see section 17.C.1.b.).

C.20. Fenders

Fenders are portable rubber, synthetic, or foam devices that protect a hull when maneuvering in close proximity to other vessels, docks or pilings. Fenders have either eye(s) or a longitudinal hole for attaching lines. They can be spherical, cylindrical, or rectangular prisms. Fender size varies greatly, and the appropriate size should be used depending on the situation. Use fenders that will keep space between vessel hulls or rub rails and hulls.

C.20.a. Fender deployment

Use plenty of fenders whenever there is the possibility of a hull making contact with another object. Strategically place fenders to account for different hull shapes (maximum beam, tumble-home, flare) or appendages (rub rails, spray rails, trawl rigs, platforms).

C.20.b. Fender placement

Because vessels are shifted around by the water, fenders may need to be moved for best effectiveness, even after strategic placement. Most vessel crews are too small to have a dedicated fender tender, therefore you should try to minimize the need beforehand.



C.21. General hardware

General hardware includes shackles, snap hooks, carbiners, swivels and other items. These items must be made of strong, low-maintenance materials. They must be easy to connect and disconnect or open and close by a crew member wearing gloves on a dark, icy night in heavy weather. All hardware should resist distortion. Shackles need a large enough throat to easily cross an eye or thimble. Use captive-pin shackles or attach the pin to the shackle with a lanyard to prevent pin loss.

Keep all hardware clean and lubricated. Inspect hardware after each use. Be particularly cautious of hardware that has been shock-loaded. Immediately replace any hardware that is distorted, spreading, excessively worn, or stripped.